VOLUME I
FINAL REPORT

ENERGY ENGINEERING ANALYSIS PROGRAM (EEAP)

ENERGY SURVEY OF
EVANS U.S. ARMY COMMUNITY HOSPITAL
FORT CARSON, COLORADO

Prepared for

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
Omaha District
Omaha, Nebraska

Under

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LIST OF ABBREVIATIONS

ACH	-	Air changes per hour
ACU	-	Air conditioning unit
AHU	-	Air handling unit
ASHRAE	-	American Society of Heating, Refrigeration, and Air Conditioning Engineers
Bldg	-	Building
Btu	-	British thermal units
Btuh	-	British thermal units per hour
CF	-	Cubic feet
cfm	-	Cubic feet per minute
COP	-	Coefficient of performance
DHW	-	Domestic hot water
DX	-	Direct expansion
EA	-	Each
ECO	-	Energy Conservation Opportunity
EMC	-	E M C Engineers, Inc.
EMCS	-	Energy Monitoring and Control System
ETL	-	Engineering Technical Letter
F	-	Fahrenheit
fc	-	foot candle
ft	-	Foot, feet
ft^2	-	Square feet
ft^3	-	Cubic feet
gpm	-	Gallons per minute
Grd	-	Ground
H/C	-	Heating/Cooling
hr	-	Hour(s)
H&V	-	Heating and ventilating
HTHW	-	High temperature hot water
HVAC	-	Heating, ventilation, and air conditioning
H_2O	-	Water
in	-	inches
I/O	-	Input/Output
KBtu	-	One-thousand Btus
KCF	-	One thousand CF
kW	-	Kilowatt, one thousand watts
kWh	-	Kilowatt-hour, one thousand watt-hours

LCC	-	Life Cycle Cost
LCCA	-	Life Cycle Cost Analysis
LF	-	Linear foot
LS	-	Lump sum
MBtu	-	One million Btus
MBtuh	-	One MBtu per hour
mW	-	Megawatt, one million watts
mWh	-	Megawatt hour, one thousand kilowatt hours
N/A	-	Not Applicable
No.	-	Number
O&M	-	Operation and Maintenance
PTAC	-	Packaged Terminal Air Conditioner
RAF	-	Return air fan
R-value	-	The resistance to heat flow expressed in units of (ft^2) x (hours) x (°F)/Btu; R-value = 1/U-value.
SAF	-	Supply air fan
SIR	-	Savings-to-Investment Ratio
UPW	-	Uniform present worth factor: a factor, which when applied to annual savings, will account for the time value of money and inflation over the life of the project.
U.S.	-	United States
U-value	-	A coefficient expressing the thermal conductance of a composite structure in Btu per (sq ft) (hour) (degrees F temperature difference); Btu/(ft^2 x hr x °F); U-value = 1/R-value.
VAV	-	Variable air volume
W	-	Watts
yr	-	Year(s)

COMMANDER'S STATEMENT

Evans U.S. Army Community Hospital spends approximately $950,000 annually for electricity and natural gas. This study identifies ten Energy Conservation Opportunities (ECOs) which will reduce annual energy costs by nearly $175,000. This study recommends the following three projects:

Proj. #	ECO(s) #	Project Name & ECO Description	Funding Program	Est. Const. Cost ($)	Net Dollar Savings ($)	Simple Payback (yrs)
1	23	**Install VAV Controls** Install Variable Air Volume on AHUs	PECIP	309,400	94,323	3.3
2	6 54A 82 25	**Repair & Upgrade HVAC** Shut-off Unneeded CW Pumps Replace Motors w/High Efficiency Motors Repair Solar Louvers Eliminate Simultaneous Heating & Cooling	Local Funding (Form 4283 only)	91,100	28,143	3.2
3	54B	**Upgrade Motors** Replace Motor w/High Efficiency Motors	Local Funding (Form 4283 only)	58,600	8,914	6.6

Four ECOs have already been implemented by DEH personnel and are saving approximately $34,000 a year in energy costs.

EXECUTIVE SUMMARY

SECTION 1.0
INTRODUCTION

AUTHORITY

This study was conducted and this report prepared under Contract No. DACA45-90-C-0036. The contract was issued and administered by the Corps of Engineers, Omaha District.

PURPOSE

The purpose of this report is to present the results of a study analyzing energy requirements and energy conservation opportunities at Evans U.S. Army Community Hospital, Fort Carson, Colorado.

SCOPE OF WORK

This study includes the following major tasks:

- Perform a complete energy audit of the hospital.
- Identify and evaluate all energy conservation opportunities (ECOs).
- Determine the feasibility of expanding the existing energy monitoring and control system (EMCS) to increase energy savings.
- List and prioritize all recommended ECOs.
- Prepare a comprehensive report which documents the work accomplished, the results, and the recommendations.
- Prepare funding documentation for all justifiable energy conservation opportunities.

METHODOLOGY

The basic methodology of the entire study has three main elements:

- Survey
- Analysis
- Reporting

Survey

Prior to conducting the building survey, several preliminary walk-throughs were made to obtain a basic familiarity with the hospital and to observe normal operation. As-built drawings were obtained from DEH personnel and, whenever possible, data on the as-builts were confirmed by field observation. Ward masters and DEH and hospital maintenance personnel were interviewed to obtain building operations information and schedules.

Analysis

The Building Loads and System Thermodynamics (BLAST) computer program was used to establish energy savings. The program was used to model the existing, or baseline, energy use of the hospital based on observation and data gathered during the survey; equipment performance data supplied by manufacturers; and professional judgement. After all architectural zones, mechanical systems, and central plant equipment were described in the baseline model, the results were compared to available utility data to validate the model. Subsequent computer models were created simulating the operating schedules and conditions for each applicable ECO. The energy savings for each ECO were found by using the BLAST program to delineate the difference in energy use between the baseline and ECO models. Interrelationships between ECOs were not considered in the Interim Report. After review comments and recommendations were received from Ft. Carson DEH personnel and the Corps of Engineers Project Manager, ECOs were re-analyzed for interrelated savings and grouped into funding projects. Maintenance cost savings were estimated based on experience. Finally, the Life Cycle Cost Analysis (LCCA) was completed using the latest ECIP guidelines. This study used the latest version of the Life Cycle Cost In Design (LCCID) computer program for the economic analysis as recommended in the SOW. After all funding projects were analyzed, funding documents were prepared and are presented in this Final Report.

Reporting

The reporting includes writing and assembling the report and completing the required funding documentation for projects developed after review of the Interim Report. Project documentation is prepared for Productivity Enhancing Capital Investment Program (PECIP) and for local funding.

RESULTS OF PREVIOUS STUDIES

No previous energy studies have been conducted at Evans U.S. Army Community Hospital. An in-house lighting survey to determine lighting levels was conducted by hospital personnel. Because details of how the survey was conducted were not recorded, the data were used only to supplement survey data and observations of this EEAP study.

MODIFICATION AND IMPROVEMENT PROJECTS

Several repairs, minor projects, and control modifications occurred between the time of the survey and the submittal of this report. Those changes which affected an ECO analysis include:

- Installing photocells on exterior lights.
- Shutting off hot water to administrative areas during the summer.
- Turning down the temperature of the outlet on the heat exchanger serving the heat recovery and preheat loop.

In each case, the change eliminated the need to analyze an ECO.

Following the submittal of the Interim Report, Fort DEH personnel implemented or began implementing the following four ECOs:

- ECO1: Shut Off AHUs and Fan Coils
- ECO2: Reduce Outside Air
- ECO5: Shut Off or Reduce Stairwell Heating
- ECO38: Convert to Energy Efficient Systems (Lights)

As a result, a new theoretical baseline was created incorporating the above ECOs. All remaining economically viable ECOs identified in the Interim Report were re-analyzed against the new theoretical baseline to determine their economic feasibility.

SECTION 2.0
BUILDING DATA

Evans Army Community Hospital consists of a hospital and clinic joined in the center by a large atrium referred to as the Commons. Construction began in March 1981 and was completed for building occupancy by February 1986. The hospital has a total of 1,398 rooms, a gross floor area of 513,700 sq ft, and provides services to active duty and retired military personnel and dependents in the nearby area. The hospital has a 195 bed capacity with provisions for future expansion to 295 beds. The hospital presently operates with less than half of its inpatient bed capacity occupied. The outpatient treatment center serves several hundred people a day. An average of 1200 personnel are either assigned to or employed in the hospital. Hospital maintenance and repair are provided by an on-site maintenance contractor under a service agreement with Fort Carson.

The five-story building is constructed of structural steel I-beams, concrete masonry units, face brick, and double pane tinted glass. Clerestory windows span the length of the Commons roof to allow daylighting and to collect solar energy.

The hospital occupies the north section of the building. The fifth, fourth, and third floors of the hospital are mainly inpatient rooms. The birthing center, an intensive care nursery, and a full-term nursery are also located on the third floor. The second floor contains eight operating rooms, an intensive care unit, a coronary care unit, inpatient bedrooms, and a dental clinic. The ground floor contains the emergency trauma, radiology, and rehabilitation centers, the kitchen, and the dining area. The service floor contains a supply processing and distribution center, a supply storage area, and a large mechanical equipment room (MER).

The Commons provides the main entries into the building at the east and west ends of the ground floor. It houses outpatient services offices, an outpatient pharmacy, the admissions office, a chapel, and gift shops.

The clinic occupies the south section of the building. The second and ground floors contain several outpatient clinics which include waiting rooms, examination rooms, and offices. The service floor contains a general storage area and administration offices.

Heat for the hospital is provided by two high temperature hot water generators located in Building 6290 north of the hospital. The rated capacity of each hot water generator is 20 MBtu/HR; both use natural gas as the primary fuel source. The high temperature water supplies thermal energy for space heating, domestic hot water (DHW) heating, and steam generation for humidification and kitchen equipment.

Refrigeration for the hospital is provided by two 370 ton centrifugal chillers located in Building 7501 immediately south of the hospital. Packaged air conditioning equipment is also used where necessary.

Electricity for the hospital is provided from the Fort Carson high voltage distribution system and is purchased from the City of Colorado Springs Utilities Department. The hospital has two 810 kW emergency generators for backup electrical power supply.

A review of survey data shows:

- Equipment is in excellent condition.
- Lighting levels are generally at or below requirements.
- Outside air flow is excessive in seventeen analysis zones.
- Supply air flow is deficient in seven analysis zones.

An evaluation of present energy use identifies areas of potential energy savings.

SECTION 3.0
PRESENT ENERGY CONSUMPTION

GENERAL

An analysis of the annual energy use at Evans U.S. Army Community Hospital was performed to determine how much is being consumed, and for what purposes. This information is necessary to act as a baseline against which various ECOs can be evaluated for energy savings and economic viability.

SUMMARY OF ALL ENERGY USE

The total estimated energy use at the hospital is summarized below in Table ES-1, and shown in Figure ES-1 on page ES-7.

TABLE ES-1
TOTAL ANNUAL ENERGY USE

Source	Quantity/yr	MBtu/yr	Annual Cost ($)
ELECTRICITY			
Lighting	2,694,990 kWh	9,198	114,515
Cooling	3,079,988 kWh	10,512	130,874
HVAC Aux. & Fans	6,288,309 kWh	21,462	267,202
Misc. Equipment	769,998 kWh	2,628	32,719
Subtotal	12,833,285 kWh	43,800	545,310
NATURAL GAS			
Space Heating	86,969.7 KCF	86,100	353,871
DHW	13,434.3 KCF	13,300	54,663
Kitchen Eqpt.	571.7 KCF	566	2,326
Subtotal	100,975.7 KCF	99,966	410,860
TOTAL	N/A	143,766	956,170

The values shown above are based on 990 Btu per cubic foot of natural gas and 3,413 Btu per kilowatt-hour.

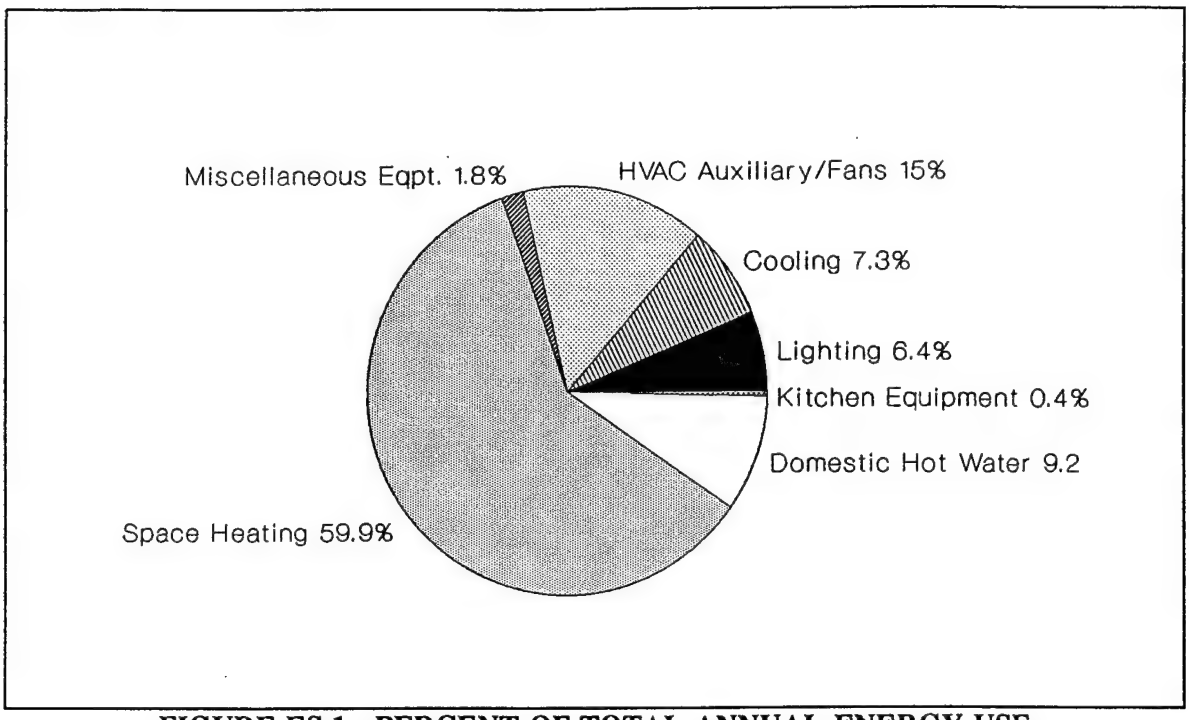

FIGURE ES-1. PERCENT OF TOTAL ANNUAL ENERGY USE

ELECTRICITY USE

Estimates of electrical energy use at the hospital were derived primarily from computer modeling of the hospital, and supplemented by hand calculations. The BLAST program was used to simulate the energy consumption of the hospital taking into account actual building construction, systems, equipment, operation, and weather variations on an hourly basis throughout a year.

All lighting in the hospital is included at present levels. The total includes exterior lighting.

Cooling energy is the electricity used by the centrifugal chillers and packaged DX units to satisfy cooling requirements throughout the year. Pumps are included in the tabulation entitled "Fans and Auxiliaries".

Miscellaneous equipment includes 120V loads (wall receptacles), small motors, elevators, and kitchen-related electrical equipment.

Figure ES-2 on page ES-8 shows the percentage of estimated electrical energy consumption by major categories. As indicated in the figure, almost half of the power used at the hospital is attributable to fans, pumps, and other HVAC related auxiliaries.

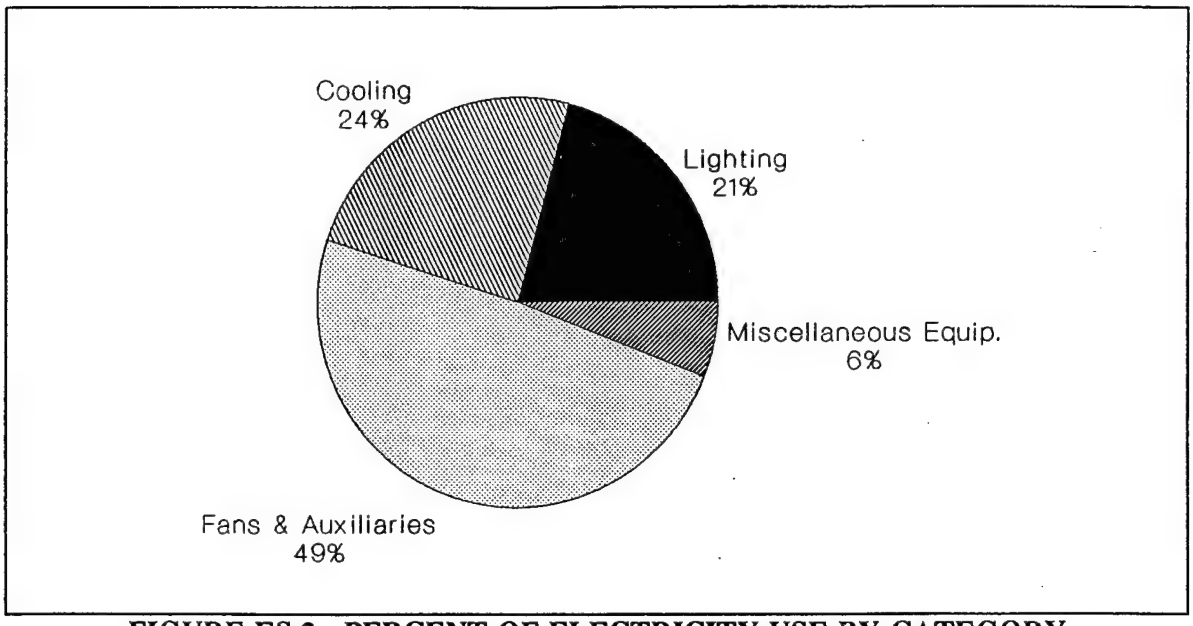

FIGURE ES-2. PERCENT OF ELECTRICITY USE BY CATEGORY

NATURAL GAS USE

The natural gas energy use estimates are shown in Figure ES-3. As noted previously, the majority of natural gas is used to generate HTHW which in turn supplies space heating, humidification, and domestic hot water (DHW).

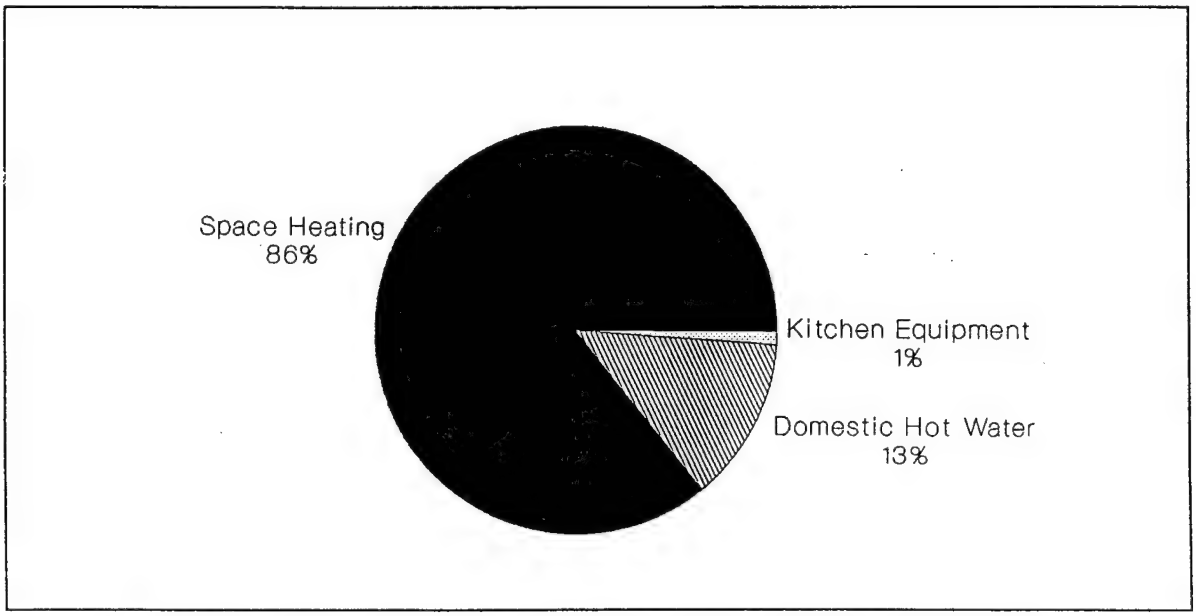

FIGURE ES-3. ANNUAL NATURAL GAS USE BY CATEGORY

SECTION 4.0
HISTORICAL ENERGY CONSUMPTION

Evans Army Community Hospital has relied upon electricity and natural gas as its sources of energy since its completion in 1986.

ELECTRICITY

The primary uses of electricity at the hospital are heating, ventilating, and air conditioning (HVAC) equipment and related auxiliaries, lighting, and miscellaneous equipment.

The electricity used at the hospital comes from the Colorado Springs Utilities Department via the electrical grid of Fort Carson. Submetering is provided at the hospital through five electric meters. The maintenance contractor is responsible for reading the meters on a monthly basis.

Sixteen months of electrical use data were supplied by Fort Carson DEH personnel; that data is presented below in Figure ES-4.

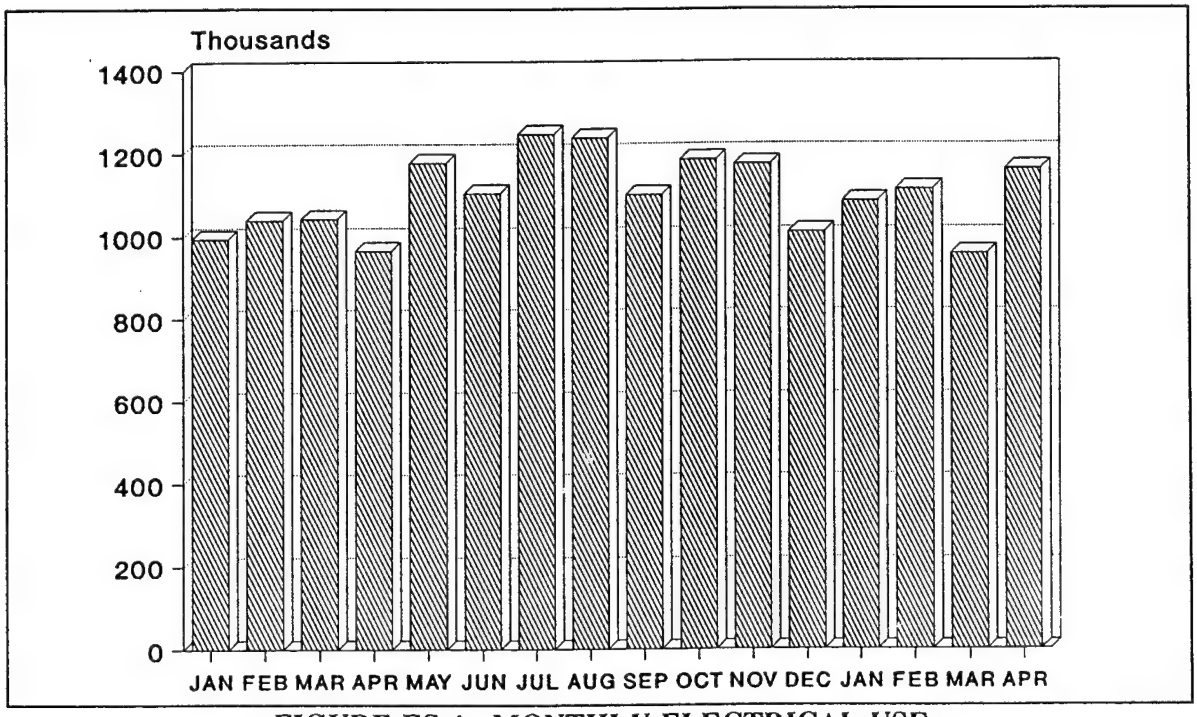

FIGURE ES-4. MONTHLY ELECTRICAL USE JANUARY 1989 TO APRIL 1990

NATURAL GAS USE

Natural gas is used by the hospital both as the primary fuel burned in the central plant which supplies HTHW to the hospital and as the direct energy source used in the kitchen appliances. Records of natural gas use in Bldg 6290 were supplied by the base maintenance contractor (General Electric).

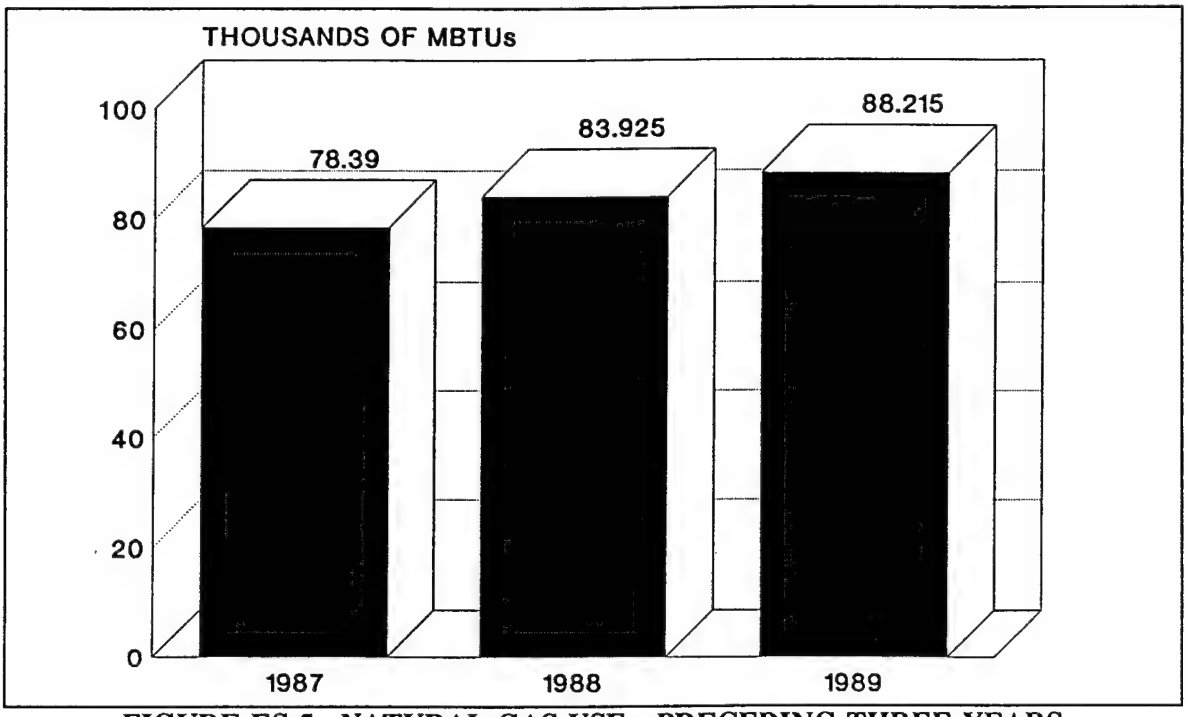

FIGURE ES-5. NATURAL GAS USE—PRECEDING THREE YEARS

SECTION 5.0
ENERGY CONSERVATION ANALYSIS

Of the eighty-two ECOs examined, fifteen were applicable to the hospital. Each of the fifteen ECOs were evaluated to determine potential energy and operating cost savings. Based on energy savings and estimated construction costs, the life cycle economics were calculated using ECIP criteria. The evaluation of the fifteen ECOs are summarized in Table ES-2 on the following page. Of the fifteen ECOs evaluated, ten showed viable life cycle economics and are recommended for implementation. Economically viable ECOs, ranked by SIR, are shown in Table ES-3 on page ES-13.

TABLE ES-2
ENERGY CONSERVATION OPPORTUNITIES SUMMARY

ECO #	ECO DESCRIPTION	ELEC. SAVINGS (MBtu/yr)	NAT. GAS SAVINGS (MBtu/yr)	DOLLAR SAVINGS ($/yr)	EST. CONST. COST ($)	SIMPLE PAYBACK (yr)	SIR
1	Shut off AHUs Whenever Possible	500	4,100	23,076	400	0.0	645.8
2	Reduce Outside Air	-500	2,200	2,817	1,700	0.6	28.8
5	Shut Off or Reduce Stairwell Heating	1	50	218	700	3.2	3.7
6	Shut Off Unneeded Chilled Water Pumps	300	0	3,735	8,300	2.2	4.2
23	Variable Air Volume Control on AHUs	6,900	3,800	94,323[1]	309,400	3.3	3.0
25	Eliminate Simultaneous Heating and Cooling	900	100	9,256[2]	30,900	3.4	2.9
38	High Efficiency Fluorescent Lamp Replacement	700	-200	7,843	64,800	8.2	1.4
45	Install Vestibules	0	90	370	9,200	25.0	0.7
54A	Replace Motors with High Efficiency Motors	1,118	0	13,919	45,100	3.3	3.8
54B	Replace Motors with High Efficiency Motors	716	0	8,914	58,600	6.6	1.9
76	Install Flat Plate Heat Exchanger	2,500	-25,600	-74,091	–	–	–
77	High Efficiency Lighting Replacement	1,300	-200	15,363	257,100	16.8	0.7
79	Install Revolving Doors at Main Entrance	0	1,100	4,521	141,400	31.4	0.5
80	Expand EMCS	700	4,100	25,751[3]	20,900	0.8	13.6
81	Evaporative Cooling of Outside Air	0	0	0	–	–	–
82	Repair Solar Louvers	0	300	1,233	6,800	5.5	3.0

NOTES:
1. Dollar savings of $94,323 includes a net maintenance cost increase of $7,200 per year.
2. Dollar savings of $9,256 includes a net maintenance cost increase of $2,360 per year.
3. Dollar savings of $25,751 includes a net maintenance cost decrease of $185 per year.

TABLE ES-3
SUMMARY OF ECONOMICALLY VIABLE ECOS

ECO #	ECO DESCRIPTION	ELEC. SAVINGS (MBtu/yr)	NAT. GAS SAVINGS (MBtu/yr)	DOLLAR SAVINGS ($/yr)	EST. CONST. COST ($)	SIMPLE PAYBACK (yr)	SIR
1	Shut off AHUs Whenever Possible	500	4,100	23,076	400	0.0	645.8
2	Reduce Outside Air	-500	2,200	2,817	1,700	0.6	28.8
6	Shut Off Unneeded Chilled Water Pumps	300	0	3,735	8,300	2.2	4.2
54A	Replace Motors with High Efficiency Motors	1,118	0	13,919	45,100	3.3	3.8
5	Shut Off or Reduce Stairwell Heating	1	50	218	700	3.2	3.7
23	Variable Air Volume Control on AHUs	6,900	3,800	94,323	309,400	3.3	3.0
82	Repair Solar Louvers	0	300	1,233	6,800	5.5	3.0
25	Eliminate Simultaneous Heating and Cooling	900	100	9,256	30,900	3.4	2.9
54B	Replace Motors with High Efficiency Motors	716	0	8,914	58,600	6.6	1.9
38	High Efficiency Fluorescent Lamp Replacement	700	-200	7,893	64,800	8.2	1.4

SECTION 6.0
ENERGY AND COST SAVINGS

GENERAL

This section presents the total projected energy and cost savings resulting from implementation of all ECOs recommended in this report. The percentage of energy conserved, as well as before and after summaries of energy use and cost, are presented graphically.

TOTAL PROJECTED ENERGY AND COST SAVINGS

The total projected energy and cost savings are shown in Table ES-4 below and graphically in Figures ES-6 and ES-7 on the following page.

TABLE ES-4
TOTAL PROJECTED ENERGY AND COST SAVINGS

Service	Quantity/Yr	MBtu/Yr	Dollars/Yr
Electricity	kWh		
Lighting	205,098	700	8,715
Cooling	263,698	900	11,205
HVAC Aux. Fans	2,647,231	9,035	112,486
Misc. Equipment	0	0	0
Subtotal	3,116,027	10,635	132,406
Natural Gas	kcf		
Space Heating	10,455	10,350	42,538
DHW	0	0	0
Kitchen Equipment	0	0	0
Subtotal	10,455	10,350	42,538
TOTAL	**N/A**	**20,985**	**174,944**

Table ES-4 above includes the savings from ECOs 1, 2, 5, and 38 recommended by this study and already implemented by Fort Carson DEH personnel.

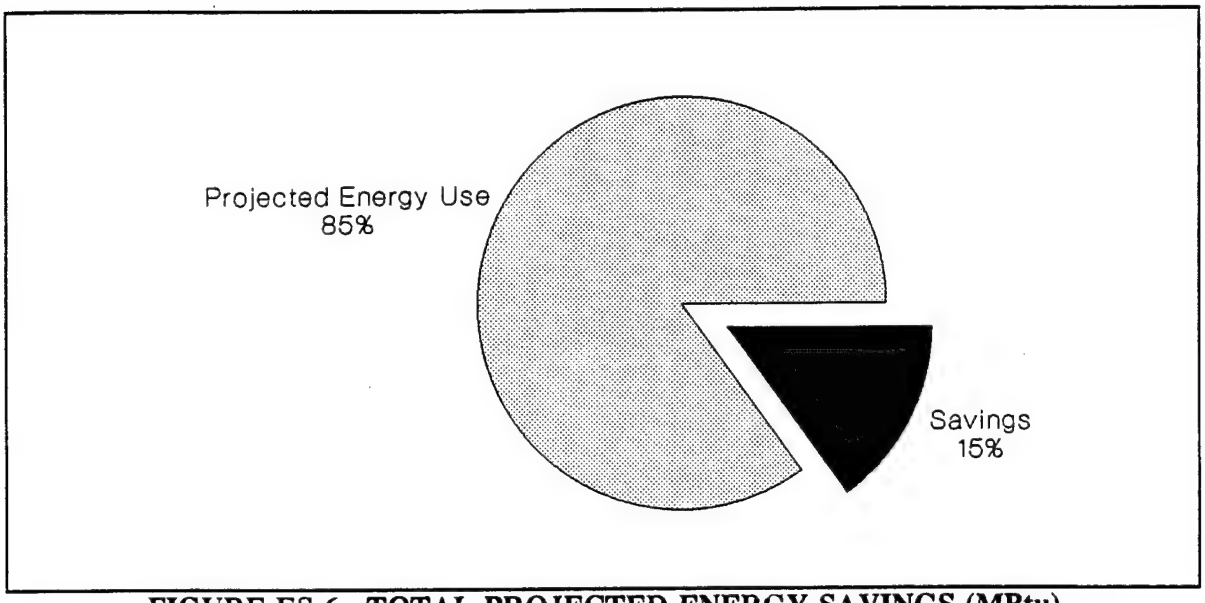

FIGURE ES-6. TOTAL PROJECTED ENERGY SAVINGS (MBtu)

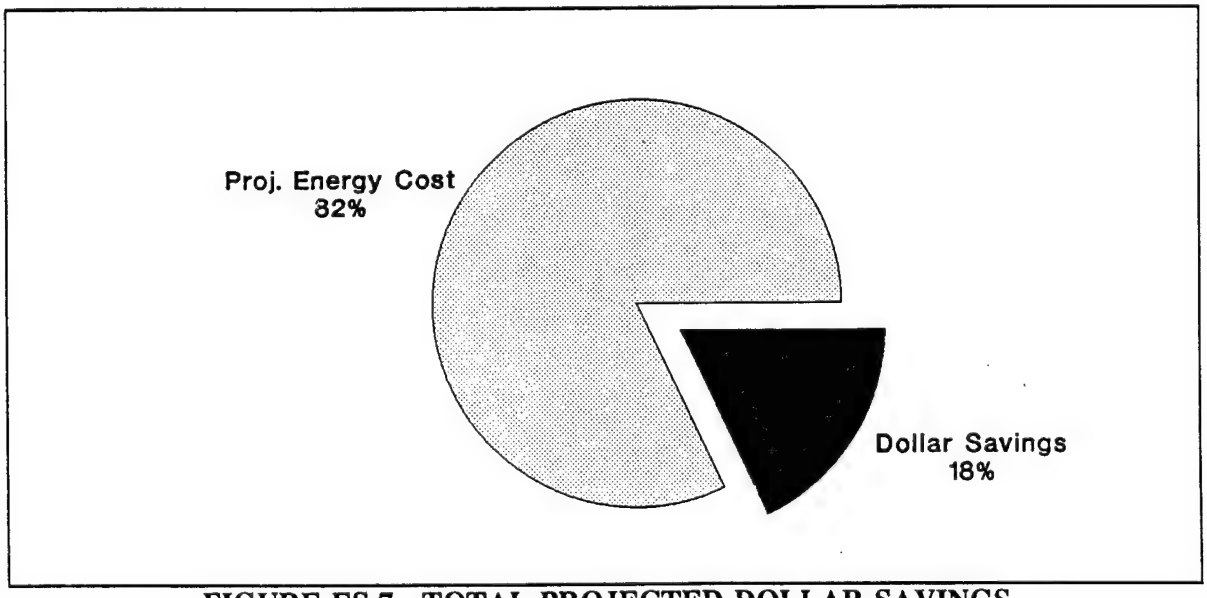

FIGURE ES-7. TOTAL PROJECTED DOLLAR SAVINGS

PERCENTAGE OF ELECTRICAL ENERGY CONSERVED

Figures ES-8 and ES-9 below show the percent of electrical use before and after implementation of all ECOs recommended in this report.

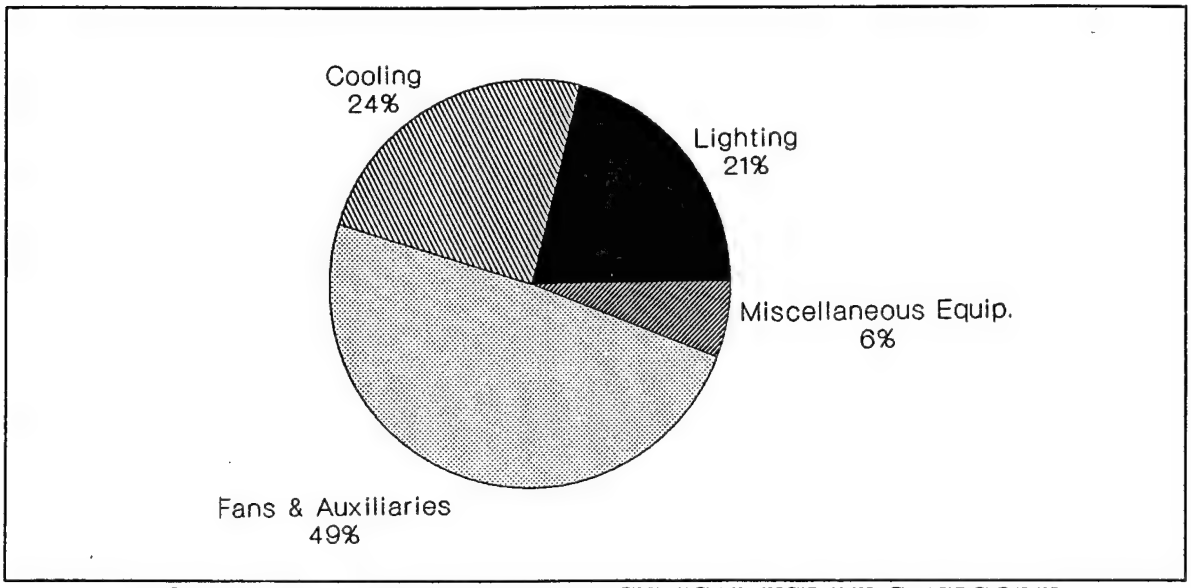

FIGURE ES-8. PERCENT OF ELECTRICAL USE BY CATEGORY

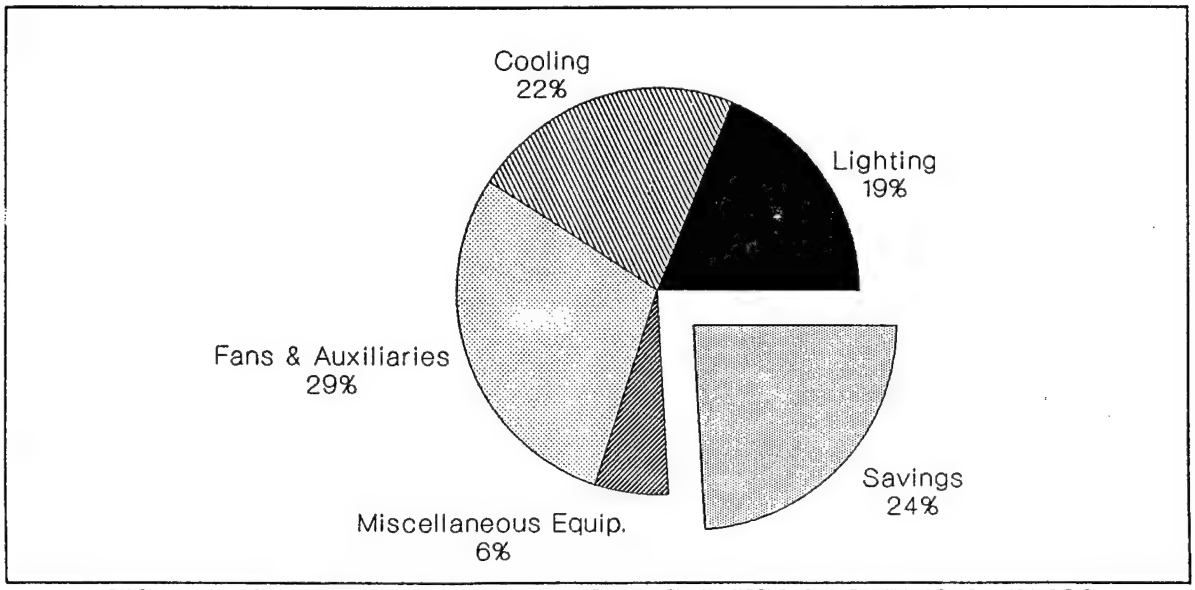

FIGURE ES-9. PERCENT OF ELECTRICAL USE SHOWING SAVINGS

PERCENTAGE OF NATURAL GAS ENERGY CONSERVED

The figures below show the percent of natural gas use before and after implementation of all ECOs recommended in this report.

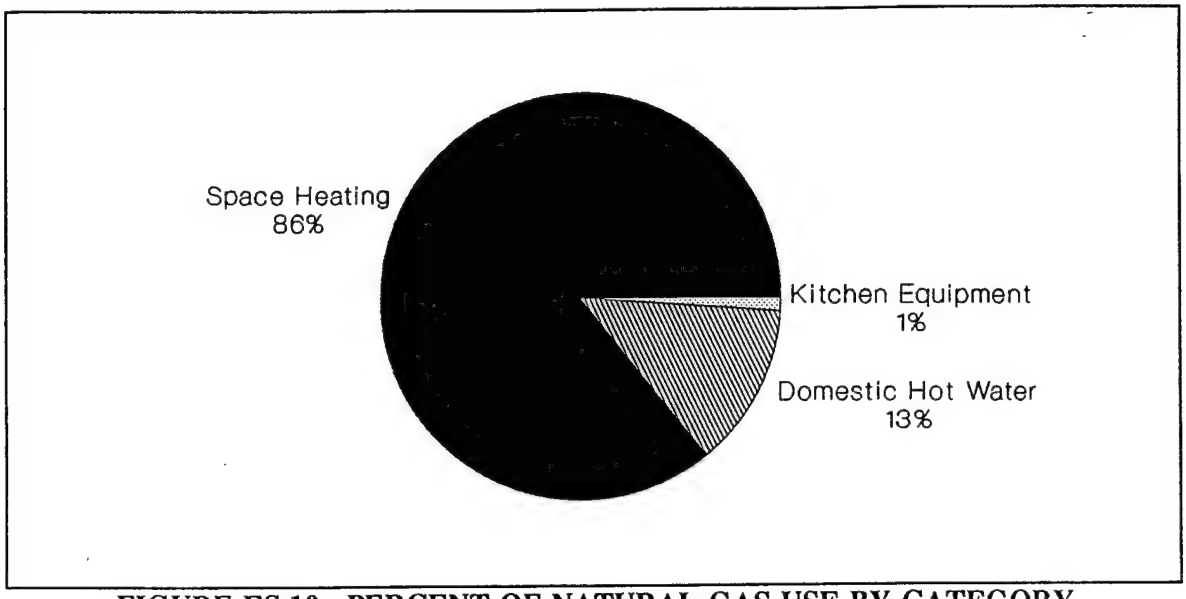

FIGURE ES-10. PERCENT OF NATURAL GAS USE BY CATEGORY

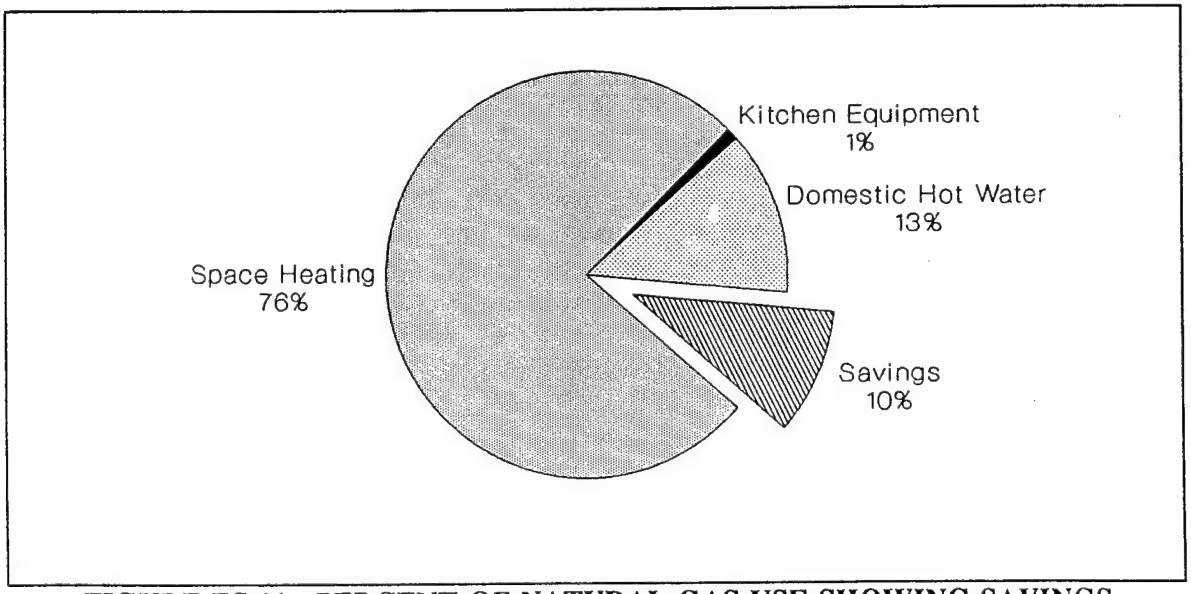

FIGURE ES-11. PERCENT OF NATURAL GAS USE SHOWING SAVINGS

SUMMARY OF FUEL USE AND COST

The summary of fuel use and cost before and after implementation of all ECOs recommended in this report is shown below in Table ES-5.

TABLE ES-5
SUMMARY OF FUEL USE AND COST

	Electricity			Natural Gas		
	kWh/yr	MBtu/yr	$/yr	kcf/yr	MBtu/yr	$/yr
Before	12,833,285	43,800	545,310	100,976	99,966	410,860
After	9,717,258	33,165	412,904	90,521	89,616	368,322
Savings	3,116,027	10,635	132,406	10,455	10,350	42,538

SECTION 7.0
ENERGY CONSERVATION PROJECTS

GENERAL

All potential Energy Conservation Opportunities (ECOs) were evaluated to determine the applicability and energy or cost savings feasibility. A list of ten economically viable ECOs was submitted as part of the Interim Report; all ten were recommended for implementation.

Following the submittal of the Interim Report, Fort Carson DEH and hospital maintenance personnel implemented ECOs 1, 2, and 5. Maintenance personnel are also pursuing ECO 38 through an ongoing replacement program. Table ES-6 below shows the recommended ECOs which have not been implemented.

TABLE ES-6
RECOMMENDED ECOs

ECO #	ECO Description	Elec. Savings (MBtu/yr)	Nat. Gas Savings (MBtu/yr)	Net Dollar Savings* ($/yr)	Est. Const. Cost ($)	Simple Payback (yrs)	SIR
6	Shut-off unneded chilled water pumps	300	0	3,735	8,300	2.2	4.2
54A	Replace motors w/high-efficiency motors	1,118	0	13,919	45,100	3.3	3.8
23	Variable air volume control on AHUs	6,900	3,800	94,323	309,400	3.3	3.0
82	Repair solar louvers	0	300	1,233	6,800	5.5	3.0
25	Eliminate simultaneous heating & cooling	900	100	9,256	30,900	3.4	2.9
54B	Replace motors w/high-efficiency motors	716	0	8,914	58,600	6.6	1.9

*Net dollar savings includes any maintenance cost increases.

RECOMMENDED PROJECTS

Based upon guidance from Fort Carson DEH personnel and the Corps of Engineers Project Manager, the above ECOs were placed into projects as shown in Table ES-7 on page ES-20.

TABLE ES-7
RECOMMENDED PROJECTS

Proj. #	ECO(s) #	Project Name & ECO Description	Funding Program	Est. Const. Cost ($)	Net Dollar Savings ($)	Simple Payback (yrs)
1	23	**Install VAV Controls** Install Variable Air Volume on AHUs	PECIP	309,400	94,323	3.3
2	6 54A 82 25	**Repair & Upgrade HVAC** Shut-off Unneeded CW Pumps Replace Motors w/High Efficiency Motors Repair Solar Louvers Eliminate Simultaneous Heating & Cooling	Local Funding (Form 4283 only)	91,100	28,143	3.2
3	54B	**Upgrade Motors** Replace Motor w/High Efficiency Motors	Local Funding (Form 4283 only)	58,600	8,914	6.6

A brief description of each project is provided below in the format required in funding documents.

Project 1: Install VAV Controls

Project Description: The constant volume reheat systems AHU 1, 2, 5, 7, 8, 9, 10, and 11 can be modified to Variable Air Volume (VAV) systems. VAV will allow a partial reduction in air flow during periods of non-peak loads and provide better temperature control while reducing reheat, cooling, and fan energy.

Detailed Justification: Modification of eight existing constant volume reheat systems to VAV systems result in total annual energy savings of $101,523. The electrical consumption is reduced by 6,900 MBtus and saves $85,905. The natural gas consumption is reduced by 3,800 MBtus and saves $15,618. It will take 3.3 years for the modifications to pay for themselves through the energy savings.

Impact if not Implemented: If this project is not implemented, a reduction of 10,700 MBtus/yr cannot be achieved and excessive amounts of natural gas and electricity will continue to be consumed. There will be no contribution to energy reduction goals established for United States Army facilities by Army headquarters.

Project 2: Repair & Upgrade HVAC

Project Description: Four ECOs were analyzed to determine their economic and technical feasibility to conserve energy at Evans U.S. Army Community Hospital. Actions necessary to implement the four ECOs are:

- Install electric to pneumatic relays to shut off the secondary chilled water circulation pumps when cooling is not needed.
- Replace fan and pump motors with high efficiency motors.
- Repair solar louvers in the Commons area to allow passive solar heating in the winter.
- Install valves and controls on the preheat coils to eliminate simultaneous heating and cooling.

Implementing the four ECOs will provide better temperature control while reducing electrical and natural gas use.

Detailed Justification: Modification to the HVAC systems results in total annual energy savings of $30,503. The electrical consumption is reduced by 2,318 MBtu/yr and saves $28,859. The natural gas consumption is reduced by 400 MBtu/yr and saves $1,644. It will take 3.2 years for the modifications to pay for themselves through the energy savings.

Impact if Not Implemented: If this project is not implemented, a reduction of 2,718 MBtu/yr cannot be achieved and excessive amounts of natural gas and electricity will continue to be consumed. There will be no contribution to energy reduction goals established for United States Army facilities by Army headquarters.

Project 3: Upgrade Motors

Project Description: Thirty-two fan and pump motors can be replaced with high efficiency motors to conserve electricity use at Evans U.S. Army Community Hospital.

Detailed Justification: Replacement of the motors results in total annual energy savings of 716 MBtu/yr and $8,914. It will take 6.6 years for the replacement motors to pay for themselves through the energy savings.

Impact if Not Implemented: If this project is not implemented, a reduction of 716 MBtu/yr cannot be achieved and excessive amounts of electricity will continue to be consumed. There will be no contribution to energy reduction goals established for United States Army facilities by Army headquarters.

SUMMARY

The three projects identified above allow implementation of all remaining economically viable ECOs. Projects 1 and 2 should be implemented as soon as funding is available; Project 3 is identified now for future funding.